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Comparison of the effect of traumatic and non-traumatic lower extremity amputations on patients' quality of life

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Abstract

The aim is to investigate the quality of life and post-amputation adaptation of patients who have undergone amputation due to trauma and chronic diseases. The physical condition, daily living activities, sports participation and Barthel Index scores of patients who underwent lower extremity amputation due to non-traumatic and traumatic causes were evaluated. The patients' social lives were evaluated according to their divorcement status, sexual status and employment status. The study included 137 patients (21 women, 116 men): 48 with traumatic and 89 with non-traumatic causes. The average age in the non-traumatic group was found to be higher (non-traumatic: 61.8, traumatic: 53.2) ($p<0.05$). The Barthel Index scores were found to be 91.4 (slight dependence) on average in the traumatic group and 78.8 (moderate dependence) in the non-traumatic group. The rates of sports participation (traumatic: 45.8%, non-traumatic: 21.3%), employment (traumatic: 54.2%, non-traumatic: 11.2%), and sexual activity were higher in the traumatic group ($p<0.05$). No difference was found between the two groups in terms of low back pain and phantom pain, but prosthesis related pain is use was found to be higher in the non-traumatic group (traumatic: 4.2%, non-traumatic:16.9%) ($p<0.05$). The prominent findings of the study indicate that patients who were amputated due to trauma showed significant differences in Barthel Index, employment status, sports participation, and sexual activity compared to those amputated due to chronic disease. These results suggest that patients who have undergone amputation due to trauma have better functional abilities and social conditions, which determine their quality of life.

Keywords: Amputation, physical activity, phantom limb pain, sexual function, quality of life

Introduction

Extremity amputations are a serious surgical procedure that can significantly impact a person's quality of life, causing notable functional, psychological, and social impairments. Following amputation, individuals may experience permanent physical changes, and differences in social, economic, psychological, and psychosocial adaptation [1]. Amputation level, the cause of the amputation, the person's age, and their psychosocial environment significantly influence how well they adapt to the amputation, perform daily physical activities, and their overall quality of life [2,3]. Lower extremity amputation satisfaction depends on clinical or demographic variables such as age, gender, level of amputation, pain perception, prosthetic factors, psychosocial well-being, adaptation to the amputation, prosthesis, and body image [4]. In individuals who have undergone amputation, the process of adapting to a changed body image often involves body-image concerns. These concerns are associated with depression, poorer perceived quality of life, lower self-esteem, and higher levels of general anxiety [5].

Lower extremity amputation is often performed on older patients due to chronic peripheral vascular disease or diabetes [6,7]. Lower extremity amputations for patients with peripheral artery disease and diabetes are typically performed in an elderly population that often has additional physical, psychological, and social issues, as well as weak social support and concurrent medical problems [8]. In addition to trauma, other causes include congenital factors, cardiovascular diseases, contractures, infections, and arthritis [9,10].

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Our hypothesis is that patients undergoing lower extremity amputation due to chronic illnesses (peripheral vascular disease and diabetes) will have worse outcomes in quality-of-life parameters, such as functional capacity, social status, sports participation, sexual health, and pain scales, compared to patients undergoing amputation due to trauma. Therefore, the aim of this study is to investigate the effect of etiology on quality of life and adaptation following amputation. In this context, the goal is to examine the differences between patients amputated due to traumatic causes and those amputated due to chronic illnesses.

Material and Methods

The study commenced after obtaining approval from the local ethics committee, and informed consent was obtained from all patients. (Protocol No: BAEK/2022/1/12). The records of patients who underwent amputations for various reasons in our clinic between 2000 and 2020 were retrospectively reviewed. Patients aged 18 and older who underwent major lower extremity amputations due to non-traumatic chronic illnesses (such as diabetes or peripheral artery disease) or traumatic causes were planned to be included in the study. Patients were contacted using the phone numbers listed in their files. Those who were unreachable due to incorrect contact information, declined to participate, could not cooperate mentally, or indicated that they could not participate due to living in another city were excluded from the study. Patients were divided into two groups: those who underwent amputation due to traumatic causes and those who underwent amputation due to non-traumatic chronic illnesses. A total of 137 patients, including 48 with traumatic causes and 89 with non-traumatic causes, were included in the study. Descriptive data of the patients are summarized in Tables 1 and 2.

Patients' physical condition and daily living activities were assessed based on their participation in sports, prosthesis usage duration, use of assistive devices during ambulation, and Barthel Index scores. The Barthel Index consists of 10 items: Bathing, Feeding, Grooming, Bowels, Bladder, Toilet Use, Transfers (Bed To Chair And Back), Dressing, Mobility (On Level Surfaces), Stairs (Table 3) [11,12]. The scoring is based on the total points the patient receives for performing these activities independently, with assistance, or not at all as follows: 0-20 points: Total dependence, 21-60 points: Severe dependence, 61-90 points: Moderate dependence, 91-99 points: Slight dependence, 100 points: Complete independence.

Patients' social lives were assessed based on marital status, sexual activity, and employment status. The status of patients' sexual activity was categorized into four groups as described in previously published studies: very active, active, low active, and not at all active [13]. To assess patients' pain after amputation, the presence of low back pain, pain related to prosthetic use, and phantom pain were investigated (Table 4).

Statistical Analysis

Statistical analysis was performed using SPSS software version 21 (SPSS Inc., IBM, Armonk, NY). Categorical variables were given in frequency, whereas continuous numeric variables were given in average values together with corresponding standard deviations. To assess the equality of variance and normal distribution for all variables, the Kolmogorov-Smirnov test was employed. Intergroup comparison of non-normally distributed age, follow up, Barthel Index, BMI and Prosthesis usage duration were analyzed with the Mann Whitney U test. Categorical variables, such as gender, side, level of amputation, advancement to a higher level of amputation, sports, able to ambulate with prosthesis, use of assistive devices, employment, sexual activity status, divorcement, low back pain, phantom pain and prosthesis related pain were analyzed by the Chi-square test. P values below 0.05 ($P<0.05$) were considered statistically significant.

Results

A total of 137 patients were included in the study, consisting of 21 women and 116 men. The cause of amputation was traumatic in 48 patients, while it was non-traumatic (due to diabetes or peripheral vascular diseases) in 89 patients. There were no statistically significant differences in gender distribution, BMI, side of amputation, level of amputation, and follow-up durations between patients with traumatic and non-traumatic causes of amputation ($p>0.05$) (Tables 1 and 2). The follow-up periods for patients in both groups range from a minimum of 24 months to a maximum of 260 months. In both groups, there was a predominance of male patients. The average age of the non-traumatic group was significantly higher than that of the traumatic group (61.8 years vs. 53.2 years, respectively) ($p<0.05$).

The Barthel Index was found to be an average of 91.4 (slight dependence) in the traumatic group and 78.8 (moderate dependence) in the non-traumatic group. The average prosthetic usage duration was 141 (±74) months in the traumatic group and 106 (±137.7) months in the non-traumatic group. Both the Barthel Index and the prosthetic usage duration were found to be significantly higher in patients with traumatic amputations. ($p<0.05$) (Table 1). In the non-traumatic group, 10 patients (11.2%) required advancement to a higher level of amputation following the initial procedure, whereas no patients in the traumatic group required an increase in amputation level. In the traumatic group, 22 patients (45.8%) engaged in sports activities, whereas in the non-traumatic group, 19 patients (21.3%) participated in sports. During mobilization, the use of assistive devices was required by 5 patients (10.4%) in the traumatic group, whereas 51 patients (57.3%) in the non-traumatic group necessitated the use of assistive devices. Statistically significant differences were observed between the two groups in terms of advancement to a higher level of amputation, participation in sports, and use of assistive devices ($p<0.05$, Table 2). However, no significant difference was found between the groups regarding the ability to ambulate with a prosthesis ($p>0.05$, Table 2).

In the traumatic group, 26 patients (54.2%) are employed, whereas in the non-traumatic group, 10 patients (11.2%) are employed. A statistically significant difference was observed between the two groups regarding employment status ($p<0.05$, Table 2).

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In the traumatic group, 7 patients (14.6%) were divorced after amputation, while in the non-traumatic group, 20 patients (22.5%) were divorced following amputation. No statistically significant difference was found between the two groups regarding divorce rates (p>0.05, Table 2). In the traumatic group, 6 patients (12.5%) were classified as very active sexually, 32 patients (66.7%) as active, and 10 patients (20.8%) as low active. In the non-traumatic group, 6 patients (6.7%) were classified as very active sexually, 25 patients (28.1%) as active, 43 patients (48.3%) as low active, and 15 patients (16.9%) as not at all active. A statistically significant difference was observed between the two groups regarding sexual activity (p<0.05, Table 2). A statistically significant difference was not found between the two groups regarding low back pain and phantom pain (p>0.05). However, a significant difference was observed between the groups with respect to pain associated with prosthetic use (p=0.032, Table 4).

Table 1. Comparison of groups in terms of age, follow up, Barthel index, BMI and prosthesis usage duration

	Etiology of amputation	N	Mean	Std. Deviation	P value
Age (year)	**Trauma**	48	53.2	6.6	**<0 .001**
	Non-traumatic	89	61.8	8	
Follow up (month)	**Trauma**	48	141.7	73.7	0.07
	Non-traumatic	89	118.3	57.8	
Barthel index	**Trauma**	48	91.4	10.7	**<0 .01**
	Non-traumatic	89	78.8	17.7	
BMI	**Trauma**	48	26.4	6.1	0.19
	Non-traumatic	89	27.6	5.2	
Prosthesis usage duration (month)	**Trauma**	48	141	74	**<0.01**
	Non-traumatic	89	106	123	

Mann Whitney U, BMI: body mass index, non-traumatic: chronic disease; diabetes mellitus or peripheral vascular disease

Table 2. Comparison of groups in terms of gender, side, level of amputation, advancement to a higher level of amputation, sport, able to ambulate with prosthesis, use of assistive devices, work, sexual activity status, divorcement

		Traumatic N, (%)	Non-traumatic N, (%)	P value
Gender	**Male**	38 (79.2)	78 (87.6)	0.18
	Female	10 (20.8)	11 (12.4)	
Side	**Bilateral**	3 (6.3)	3 (3.4)	0.3
	Right	14 (29.2)	37 (41.6)	
	Left	31 (64.6)	49 (55.1)	
Level of amputation	**Below-knee**	32 (66.7)	52 (58.4)	0.34
	Above-knee	16 (33.3)	37 (41.6)	
Advancement to a higher level of amputation (re-amputation)	**Yes**	0 (0)	10 (11.2)	**0.01**
	No	48 (100)	79 (88.8)	
Sport	**Yes**	22 (45.8)	19 (21.3)	**<0.01**
	No	26 (54.2)	70 (78.7)	
Able to ambulate with prosthesis	**Yes**	42 (87.5)	71 (79.8)	0.25
	No	6 (12.5)	18 (20.2)	
Use of assistive devices	**Yes**	5 (10.4)	51 (57.3)	**<0.01**
	No	43 (89.6)	38 (42.7)	
Employment	**Employed**	26 (54.2)	10 (11.2)	**<0.01**
	Unemployed	22 (45.8)	79 (88.8)	
Sexual activity status	**Very active**	6^{a} (12.5)	6^{b} (6.7)	**<0.01**
	Active	32^{a} (66.7)	25^{b} (28.1)	
	Low active	10^{a} (20.8)	43^{b} (48.3)	
	Not at all active	0^{a} (0)	15^{b} (16.9)	
Divorcement	**Bachelor**	0 (0)	3 (3.4)	0.21
	Yes	7 (14.6)	20 (22.5)	
	No	41 (85.4)	66 (74.2)	

Chi square test. Each subscript letter in Sexual activity status represents a significant difference at the 0.05 level in the same line

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Table 3. Barthel index

Bathing	0=dependent 5=independent
Feeding	0=unable 5=needs help 10=independent
Grooming	0=needs to help with personal care 5=independent face/hair/teeth/shaving
Dressing	0=dependent 5=needs help 10=independent
Bowels	0=incontinent 5=occasional accident 10=continent
Bladder	0=incontinent, or unable to manage alone 5=occasional accident 10=continent
Toilet use	0=dependent 5=needs some help 10=independent
Transfers (bed to chair and back)	0=unable, no sitting balance 5=major help (one or two people, physical), can sit 10=minor help (verbal or physical) 15=independent
Mobility (on level surfaces)	0=immobile or <45 meters 5=wheelchair independent, including corners, >45 meters 10=walks with help of one person (verbal or physical) >45 meters 15=independent (but may use any aid; for example, stick) >45 meters
Stairs	0=unable 5=needs help (verbal, physical, carrying aid) 10=independent

The Barthel Index categorization of the total score: 0-20 point: total dependence, 21-60: severe dependence, 61-90: moderate dependence, 91-99: slight dependence, 100: complete independence

Table 4. Comparison of groups in terms of pain parameters

		Traumatic N, (%)	Non-traumatic N, (%)	P value
Low back pain	**Yes**	15 (31.3)	34 38.2)	0.41
	No	33 (68.8)	55 (61.8)	
Prosthesis related pain	**Yes**	2 (4.2)	15 (16.9)	0.03
	No	46 (95.8)	74 (83.1)	
Phantom pain	**Yes**	5 (10.4)	16 (18)	0.24
	No	43 (89.6)	73 (82)	

Chi square test

Discussion

In this study, the social and functional conditions of patients were compared based on the etiology of their amputation. The most significant findings are that patients amputated due to trauma showed a significant difference compared to those amputated due to chronic illness in terms of Barthel Index scores, employment status, participation in sports, and sexual activity status. These findings indicate that patients with traumatic amputations have better functional and social conditions, reflecting a higher quality of life.

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Limb loss can create adaptation issues in patients from both social and functional perspectives. Adaptation problems may vary depending on the etiology of the amputation; however, there are very few studies on this topic, and it has not been thoroughly investigated [10]. It is also known that various factors, such as the level of amputation, the patient's age, and socioeconomic status, can impact physical activity, social life, and functional capacity after amputation [14,15]. Littman et al. [14] emphasized in their study that patients who underwent amputation due to trauma have higher levels of physical activity. This has been attributed to the fact that traumatic amputation patients have a higher average age compared to non-traumatic amputation patients (67.2 years versus 63.3 years in Littman's study) and have fewer comorbidities. In their study, Greive et al. [16] found that most patients experienced a decline in functional abilities after amputation. They identified age as a major factor contributing to the decline in functional abilities. However, it has not been clearly determined whether the reduction in functional abilities is due to age itself or to the coexisting morbidities. In our study, the average age of individuals who underwent amputation due to trauma was found to be lower than that of non-traumatic amputation patients, which is consistent with the literature (53.2 years versus 61.8 years). Additionally, in our study, the Barthel Index was used to assess physical condition and dependency [17]. In traumatic individuals, the average score was classified as slight dependence, whereas in the non-traumatic group, the average was classified as moderate dependence. Consistent with the literature, the traumatic group demonstrated better physical condition and independence. It is anticipated that favorable outcomes in lower extremity amputations are more likely to be achieved in younger patients who begin early ambulation with a prosthesis, do not have contractures, and are actively involved in the medical rehabilitation process [18].

Due to difficulties in walking, older amputee individuals often use their prosthesis significantly less. These patients may also discontinue using their prosthesis during the rehabilitation period [19]. In our study, the duration of prosthetic use was found to be lower in the non-traumatic group. Reduced prosthetic use is significantly associated with factors such as age, female gender, use of a wheelchair, level of physical disability, cognitive impairment, patient dissatisfaction, and overall health status [19]. Learning to walk with a prosthesis requires cognitive ability, conditioning, and balance, and walking distance also has significant psychosocial effects.. Additionally, older individuals are more prone to falls due to impaired balance and coordination [20]. In our study, a higher use of assistive devices was observed in the non-traumatic group. The level of amputation is a crucial factor in predicting the success of rehabilitation. As the level of amputation increases, the use of prostheses decreases. This is due to the greater energy demands of above-knee prostheses compared to below-knee prostheses [21]. Patients with below-knee amputations generally have better walking speed. In our study, no significant difference was found between the two groups in terms of amputation level and the ability to ambulate with a prosthesis.

The risk of re-amputation after lower extremity amputation due to chronic illness is higher compared to traumatic amputation cases [22]. In the study conducted by Dillingham et al. [23], it was demonstrated that 34% of patients who underwent lower extremity amputation required re-amputation. Similarly, in the study conducted by Baysal et al. [24], risk of re-amputation following amputation due to chronic illnesses was found to be 33.8%. In our study, no cases of re-amputation were observed in the traumatic group, whereas 11.6% of patients with amputations due to chronic illness required re-amputation. The lower re-amputation rate observed in our study compared to the literature may be attributed to the fact that only major limb amputations were included.

Engaging in sports positively impacts both the physical capacity and psychosocial well-being of individuals who have experienced limb loss [25]. In his study, Tatar [26] highlights that participating in sports can alter the body image of amputee patients, which can have positive social and psychological effects. However, in amputee patients, particularly those of advanced age, limitations in sports and physical activities are commonly observed. Additionally, even younger patients may require significant motivational factors to engage in sports [27]. In our study, a higher rate of participation in sports was observed among patients who underwent amputation due to trauma. This can be attributed to their younger age and lower risk of chronic illnesses compared to the non-traumatic group.

After lower extremity amputation, patients often face challenges in returning to work. Sirzai et al. [28] reported a 61% employment rate following amputation in their study. Additionally, Sirzai et al. found that 37% of patients returned to work in jobs they did not prefer, and 48% reported a loss of productivity compared to before their illness. In our study, the return-to-work rate was 54.2% in the traumatic group and 10% in the non-traumatic group. The lower average age of 36 years in Sirzai's study compared to our study may explain the differences in return-to-work rates. Furthermore, the significantly higher return-to-work rate observed in the traumatic group of our study could also be attributed to the differences in average age.

Amputation is known to cause sexual issues and sexual dysfunction. Woods et al. [29] emphasized in their study that participants in the post-amputation rehabilitation process often report being sexually inactive. They also reported that 60% of those who were sexually active experienced sexual dysfunction. In the study conducted by Williamson et al. [13], it was highlighted that three-quarters of patients experienced limitations in their sexual activities following amputation. In our study, the level of sexual activity was found to be significantly higher in patients who underwent amputation due to trauma. One of the reflections of psychological adjustment issues following amputation may be divorce. It is known that the depression symptoms in divorced patients are twice as high compared to those who are married

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[30]. Dougherty et al. [31], in their study on patients following traumatic amputation, found that the divorce rate was 23% after an average of 23 years of marriage. In alignment with the literature, our study found a divorce rate of approximately 20%. Additionally, the lack of a significant difference between the traumatic and non-traumatic groups suggests that the etiology of amputation may not have a substantial impact on divorce rates.

One of the significant factors affecting quality of life after amputation is pain. Phantom pain, prostheses releated pain, and low back pain are among the most common complaints. Low back pain is often attributed to adaptation challenges post-amputation, such as changes in load capacity and inconsistencies in load during walking [32]. Sadowski et al. [33] highlighted that the likelihood of experiencing low back pain is 1.58 times higher in amputees compared to the general population. In our study, low back pain was present in 35% of cases, with no significant difference between the traumatic and non-traumatic groups. Phantom pain after amputation can vary among patients. The presence and severity of phantom pain are unrelated to general psychiatric symptoms [34]. In the study by Gallagher et al. [35], it is highlighted that 62% of patients may experience phantom pain and 48% may experience limb pain after amputation. In the study conducted by Houghton et al. [36], it is stated that there is no difference in phantom pain between traumatic and vascular-origin amputations. According to the study by Dillingham et al. [37], 25% of patients reported experiencing pain associated with their prosthesis. Our study found no significant difference in phantom pain between the two groups, aligning with the literature. However, prosthesis-related pain was significantly higher in the non-traumatic group. This finding may be one of the factors contributing to the reduced prosthesis usage observed in the non-traumatic group.

Limitations

One of the primary limitations of this study is the age difference between the groups. However, this difference can be considered natural, as patients amputated due to chronic diseases are typically older, whereas those amputated due to trauma are often younger and more active. Another limitation is the wide range of follow-up periods, and although there was no statistically significant difference, the variation in follow-up durations between groups is noteworthy.Not differentiating between early and late postoperative patients is another significant limitation. Additionally, patients were called to the hospital for inclusion in the study, and those unable to come to the hospital were not included, which is another notable limitation.

Conclusion

In this study, the social and functional statuses of patients were compared based on the etiology of their amputations. The key findings of the study indicate that patients amputated due to trauma show significant differences in Barthel index scores, employment status, sports participation, and sexual activity compared to those amputated due to chronic diseases. These results suggest that individuals who undergo amputation due to trauma have better functional and social conditions, which are crucial determinants of their quality of life.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
Ethical approval for this study was obtained from the University of Health Sciences, Samsun Training and Research Hospital, Scientific Research Ethics Committee. Informed consent was obtained from patients to use all patient information. Research protocol code: BAEK/2022/1/12, date:12.01.2022.

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